

09/719900
JC01 Rec'd PGT/PTO 19 DEC 2000

Express Mail Label
No. EL398544095US

December 18, 2000
(Date of Deposit)

- 1 -

ALUMINIUM

Treatment of an ~~Aluminium~~ Alloy Melt

Antoinette Sullo
Name and Reg. No. of Attorney
Antoinette Sullo
Signature
12-18-00
Date of Signature

The invention concerns a process to reduce the susceptibility to ~~scabbing~~ ^{cross-forming} of an aluminium alloy melt with a content of at least 2.5 w.% magnesium.

On an interruption to work in a foundry, for example over holidays or a weekend, a metal melt ready for casting can be held for more than 50 hours at a melt temperature of 750°C for example. After a long standing time, aluminium magnesium alloys with a high magnesium content have a tendency to ~~scabbing~~ ^{cross-forming}. The presence of magnesium in the melt causes the protective oxide skin, which normally prevents oxidation of the aluminium, to become permeable and the aluminium can react with oxygen. On the melt forms a cauliflower-like ~~scab~~ ^{cross} which consists mainly of spinel ($MgO \cdot Al_2O_3$). This process is reinforced further in the cover heating furnace as the surface temperature of the metal bath, due to the radiant heat of the heating rods in the cover, is very high and convection in the metal bath is prevented by temperature layering. Because of the segregation due to gravitational force, magnesium becomes enriched close to the melt surface and leads to further reinforcement of this effect. The ~~scab~~ ^{cross} forming is very hard, has a cauliflower-like morphology and falls to the base of the crucible so that the entire furnace can be contaminated if the ~~scab~~ ^{cross} is not removed early enough. Scabbing commences earlier the higher the melt temperature.

It is known that the ~~scabbing~~ ^{cross-forming} of aluminium magnesium alloys can be reduced but not totally avoided by the addition of beryllium. It has been observed that the beryllium content of an aluminium magnesium alloy in the melt diminishes with time and evidently, when the beryllium concentration falls below a critical level, ~~scabs~~ ^{crosses} rapidly begin to form on the melt. An increased addition of beryllium to the metal melt is undesirable because of the carcinogenic properties of beryllium and should therefore be avoided as far as possible.

A3
5 The invention is therefore based on the task of using alloy technology measures to lead to a higher ~~scabbing~~ ^{gross-forming} resistance for aluminium magnesium alloys than is possible with an addition of beryllium according to the state of the art.

The task is solved according to the invention in that to the melt is added 0.02 to 0.15 w.% vanadium and less than 60 ppm beryllium.

10 Surprisingly it has been found that by the addition of vanadium, the ~~scab-reducing~~ ^{gross-reducing} addition of beryllium can take place in a substantially lower quantity than without the vanadium addition, where in general the addition of vanadium
15 in a quantity of less than 0.05 w.% is sufficient even in alloys with a content of more than 5 w.% magnesium.

Preferably 0.02 to 0.08 w.% vanadium, in particular 0.02 to 0.05 w.% vanadium, is added to the melt.

20 For a content of more than 3.5 w.% magnesium, the addition of 25 to 50 ppm beryllium is sufficient, preferably 25 to 35 ppm beryllium. If the content of magnesium in the melt is less than 3.5 w.%, less than 25 ppm beryllium is required to
25 achieve a high ~~scabbing~~ ^{gross-forming} resistance. For lower requirements for the ~~scabbing~~ ^{gross-forming} tendency, the beryllium addition can even be omitted completely.

A preferred use of the process according to the invention
30 lies in the production of casting alloys with
2.5 to 7 w.% magnesium
max 2.5 w.% silicon
max 1.6 w.% manganese
max 0.2 w.% titanium
35 max 0.3 w.% iron
max 0.2 w.% cobalt
less than 60 ppm beryllium
0.02 to 0.15 w.% vanadium

00010000121000

[illegible]

10

15

20

25

30

30

3!

Secondly, with the addition of vanadium in the range according to the invention, a beryllium content of around 25 ppm is sufficient to increase substantially the ~~scabbing~~ ^{cross-forming} resistance.

Table 1

Batch	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Be	V
①	2.36	0.08	<0.001	0.78	5.31	<0.001	0.002	0.13	0.0011	0.072
2	2.30	0.08	<0.001	0.74	5.69	<0.001	0.01	0.11	0.0043	0.0052
③	2.37	0.08	<0.001	0.79	5.28	<0.001	0.002	0.12	0.0026	0.080
④	2.38	0.08	<0.001	0.78	5.27	<0.001	0.002	0.08	0.0026	0.072
5	2.47	0.11	<0.001	0.70	6.29	<0.001	0.006	0.13	0.0033	0.021
6	2.13	0.09	<0.001	0.70	5.61	<0.002	0.005	0.15	0.0025	0.045

Invention

Comparative

Table 2

Batch	Be content [ppm]	V content [w. %]	Time until Dross-Forming Scabbing [h]
①	11 low	0.072 %	68
2	43	0.005	63
③	26	0.080	158
④	26	0.072	139 *)
5	33	0.021	160 *)
6	25	0.045	171 *)

*) Not ^{drossed} scabbed, test interrupted.

00710000 44500